



Effects of Flipped Classroom on High- and Low-achievers' English Vocabulary Learning

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The flipped classroom, an approach that extends learning beyond the classroom, has been extensively and empirically researched in the science and math disciplines. However, whether the flipped classroom is feasible in senior high school education—where variation in student performance is of particular concern—has yet to be examined. In this light, this study set out to verify the feasibility and effectiveness of the flipped classroom in high school education, and to compare its effects with conventional lecture-based instruction on high school students with different levels of foreign language (English) vocabulary knowledge. After six weekly sessions, it was found that both methods of instruction were effective in promoting vocabulary gains. However, the flipped classroom was better able to reduce variation among students in a multi-level class. Importantly, although both high and low achievers benefited from the flipped classroom instruction and were left with a positive attitude toward the additional workload it entailed, the effect of the flipped classroom seems to be more manifest in low achievers. Based on the above findings and the results of questionnaire data, the pedagogical implications are discussed.

Keywords: flipped learning, L2 vocabulary learning, differentiated learning

Introduction

A flipped classroom is a type of blended learning that reverses traditional pedagogical practice by requiring students to preview instructional content (often online) at home and moving experiential or hands-on activities that are usually done outside of classroom (e.g., lab experiments, peer reviews, and presentations, and PBL) into the classroom (see Bishop & Verleger, 2013; Jhong, Song, & Jiao, 2013). Although instruction that takes place outside of the classroom may take different forms, learning is not restricted to time and space constraints in class. Because 'content delivery' is mostly done outside of the classroom, more time can be spent in class on higher-order thinking, usually guided by a teacher; and importantly, throughout various collaborative activities, students are invited to co-construct knowledge with their teacher and peers. This allows them to learn actively, increases motivation and facilitates deeper levels of understanding.

The concept of the flipped classroom was first proposed by Jonathan Bergmann and Aaron Sams in 2007, both high school teachers in Colorado, U.S.A. Several years later, Bergmann and Sams (2012) proposed eight principles for running and managing flipped classrooms: 1) Interaction between students and teachers should be maximized; 2) Students should take charge of their own learning environment; 3) The role of teachers as guides should be enhanced; 4) Activities in class should integrate both narrative and constructivist-associative learning; 5) Classes should be designed to allow absent students to access materials and make up their learning; 6) Students should be provided with sustainable learning materials or resources (e.g., recorded content) for students to revisit/review; 7) The design of the curriculum should encourage students to take part in the proposed learning activities; 8) All students should benefit from personalized education (Bergman & Sams, 2012).

In addition to the above eight principles, Zhang, Wang and Zhang (2005, 2012) noted that activities in a flipped classroom should be student-centered; specifically, students should be proactive in (re)searching, discussing and studying information before class and active participants during in-class learning activities. Consequently, students cease being passive receivers of information and become active explorers who take ownership of and responsibility for their learning. In this case, teachers are afforded the opportunity to explore individual students' learning difficulties and styles, enabling them to draw on a wide range of methods to cater to individual needs. Accordingly, the flipped classroom tends to produce a constant "conversation" between students with different levels of proficiency, making use of small group activities and thereby creating the possibility of effective collaborative learning (Herreid & Schiller, 2013). In this manner, differentiated instruction and learning are made possible.

Despite the aforementioned potential and merit, the effectiveness of flipped classroom has not been researched in the context of mixed-level foreign-language (FL) classes. Although Chen and Liu (2019) have explored the effectiveness of a flipped approach on EFL learners' perception, they did not draw on their performance data. It is yet to be empirically established whether the flipped classroom has the potency to enhance high- and low-achieving students' FL learning outcomes to the same extent; and if not, which group of FL learners (high vs. low) would benefit more from the flipped classroom instruction. With this in mind, this study compares the relative effects of flipped classroom and conventional lecture-based classroom instruction on high school students of different FL (English) vocabulary attainment levels. Two questions were explored:

1. Is flipped classroom instruction more effective than traditional lecture-based teaching in enhancing English vocabulary acquisition in multi-level intact classes?
2. Does flipped classroom instruction exert a selective effect on high or low achievers regarding vocabulary acquisition?

Literature Review

Flipped classroom has been implemented and studied in different disciplines (e.g., Al-Zahrani, 2015; Butt, 2014; Clark, 2015; Kong, 2014; Lai & Hwang, 2016; Mok, 2014; see also Chen, 2016). The past two decades have witnessed a growing research on flipped classroom in the domain of second-language (L2) and FL education. This section will review major empirical studies that specifically investigated the effects of a flipped classroom approach on ESL and EFL learners. These studies have unequivocally yielded evidence to support the positive effects of the flipped classroom in enhancing English learning outcomes and in boosting students' positive perceptions towards flipped classroom (e.g., Hahn, 2012; Teng, 2017; Wang & Jhang, 2013). To begin with, Wang and Jhang (2013) investigated 16 junior college students in Taiwan on the benefits of flipped classroom teaching and their attitudes towards it. The study was divided into three parts: before, during and after class. The teacher allocated previewing tasks and materials to the students to complete before class. During the class, students were asked to form groups to complete activities with occasional guidance from the teacher. The students then uploaded their

completed work to an online platform after class. The teacher then viewed the work and gave the students feedback. The results showed that flipped classroom led to improved grades in listening, speaking, reading, writing and Chinese-English translation. The students also expressed a preference for flipped classroom teaching. Chen-Hsieh, Wu and Marek (2016) compared the relative effects of a flipped classroom and a conventional lecture-based classroom on 48 college students studying English and explored their experience of the flipped classroom. The Line smartphone app was used as a learning platform for the flipped classroom. The results were positive regarding the students' English idiomatic knowledge and learning experience

The other thread of flipped classroom explores the effect of a flipped approach on promoting students' positive affect. Teng (2014) explored 90 EFL students' academic performance, oral presentations, and perception about flipped classroom. Results showed that the participants assigned to the structured flipped classroom instruction exhibited the most significant gains in their academic achievement, and overall communicative skills, followed by those assigned to the semi-structured flipped classroom instruction and those to the traditional classroom. This indicates that flipped classroom exerted the optimal positive impact on students when it is carefully structured. Similarly, Hung (2015) also observed that EFL learners attending flipped lessons showed significant improvements in a communicative English class.

Importantly, the students assigned to the structured flipped classroom in Teng (2014) and Hung (2015) all showed a higher level of positive attitude toward the perceived "usefulness, feasibility and agreeability," which in turn positively enhance their willingness to participate in flipped classrooms (Teng, 2017, p. 616). Drawing on questionnaire and survey data, Hahn (2012), and Webb, Doman, and Pusey (2014) all observed that students assigned to flipped classrooms generally enjoyed the course content more than those in a traditional classroom, although some students—the participants from Webb et al.'s (2014) study—still prefer the traditional teacher-center instruction. Additionally, students assigned to flipped classrooms generally found the course materials helpful and effective in promoting their creativity and learning outcomes, in particular with regard to higher-order thinking (see the same finding in the domain of science education, Touchstone, 2015). Similarly, the participants in Chen-Hsieh et al. (2016) reported that the flipped classroom is more engaging and beneficial to them for learning English idioms. Moreover, most of the students felt that although the flipped classroom increased their workload, the benefits made it worthwhile.

Focusing on younger (elementary) EFL learners, Hsu (2015) conducted a two-year study on flipped classroom teaching with an elementary school English class. Analogous to the findings of extant research on older (college) EFL learners, Hsu found that a flipped approach led to better academic gains and resulted in a more positive mindset. Specifically, a flipped classroom group (experimental group) and a traditional classroom group (control group) were compared to evaluate the feasibility of using the flipped classroom approach for English learning at the elementary school level. The participants were students from a prominent elementary school in Guangzhou, China. Two classes of 46 students took part in this study, making 92 students in total. At the onset of the study, the researcher evaluated both groups to explore how elementary school students use the internet to learn English at home. An online English learning platform was then installed on the students' home computers. Via this platform, the teacher provided the students with video learning materials and resources. The students were asked to preview, study, and discuss these video materials prior to class. The students continued their discussions and shared/presented their discussion results in class. At the end of the study, a test was administered to assess performance, along with a survey and an interview to collect qualitative data. This was to probe the students' perceptions and experiences. The findings showed that the flipped classroom approach led to significantly improved English grades and a heightened interest in learning English. The students were interested in the flipped classroom approach due to the frequent opportunities it provided for interaction among peers, with students better able to collaborate, share and discuss ideas. The flipped classroom was also more effective in helping students retain information.

Despite the positive evidence from the aforementioned studies, it must be noted that it remains an open question whether high achievers and low achievers would benefit from flipped classroom instruction to

the same extent. Additionally, limited research is delved into high and low achievers' perceptions toward a flipped approach. Chen and Liu (2019) explored high and low achievers' perception toward the workload and preferred activity form in flipped and traditional classrooms. They found that while high achievers could accept longer (2 hours) of preparatory work prior to class, low achievers could only accept one hour of preparatory work. Furthermore, while high achievers generally prefer individual work to group work, low achievers showed the opposite predilection. Although Chen and Liu showed qualitative differences in high and low achievers' perception toward flipped classroom instruction, their study has not examined the relative effects of the flipped approach on high and low achievers' language learning outcomes. If the flipped classroom only selectively exerts a beneficial effect on students of a particular level (either high or low achievers), then it would lose its value in intact multi-level classes which typically consist of both high and low achievers. Thus, this study aims to investigate the efficacy of flipped classroom on high school students of different English levels regarding their English vocabulary acquisition.

Method

Participants

Two classes of second-year students from northern Taiwan participated in this study. Class A received the flipped classroom treatment (experimental group; see below for more detail) and Class B received conventional lecture-based instruction (control group). In total there were 87 students, with Class A made up of 42 students and Class B with 45 students. Although the two classes were comparable in terms of their overall English achievement group profile as gleaned from the average of their mid-term and final exam scores over the previous year, there were individual differences in their vocabulary knowledge within each class. Nonetheless, the achievement test score distribution (for high achievers and low achievers) was very similar between the two classes. Specifically, the average scores for Class A's high and low achievers (students above and below the 50% percentile) in the first year was 82.3 and 78.3, respectively. The average scores for Class B's high- and low-achievers were 83.5 and 79.3, respectively. From this we can see that the two classes were very similar in terms of achievement test score distribution.

The flipped classroom lessons and conventional lecture-based lessons were both taught by the same teacher. At the time of this study, the teacher had 19 years of English teaching experience in high schools, having instructed both gifted program classes and general classes.

Design and Materials

Class A and Class B received the same amount of instruction: one session of 50 minutes a week for 6 weeks. In each session, the teacher taught 15 (new) target vocabulary words, using the same textbook and the same target vocabulary with both the experimental and control groups. However, the two groups differed in terms of how the vocabulary was taught and learned. The instructional differences between the flipped classroom and lecture-based classroom are given in details below.

Flipped classroom

Before the onset of the six-week treatment, the experimental group students in Class A were put in groups following the heterogeneous grouping principle prescribed by Yeh (2014). According to this principle, for optimal learning outcomes, groups should be composed of students of different ability levels (Farenga & Ness, 2005)—a recommendation reminiscent of the concept of the zone of proximal development proposed by psychologist Lev Vygotsky. In the vein of the heterogeneous grouping

principle, the students in the flipped classroom class were first divided into two subgroups according to their first-year English grades: “high achievers” (with performances above the 50% percentile) and “low achievers” (with performances below the 50% percentile). Then, the high achievers and low achievers were equally assigned to six groups. Yeh (2014) points out that in heterogeneous grouping, high achievers can enhance their teaching abilities while assisting those that have trouble, whilst low achievers can boost their learning efficacy in order to collaborate with high achievers. For this study, the flipped classroom procedure followed the one recommended by the website “I think, I try; I teach, I tweak,” a flipped classroom forum constructed and maintained by Professor Bing-Cheng Yeh (2014)—an eloquent and influential pioneer and proponent of flipped classroom practice in Taiwan. According to Yeh (2014), flipped classroom procedure should consist of three phases: 1) preparation phase, a time for teachers to prepare all necessary procedures and materials; 2) acclimation phase, a time for students to preview materials and prepare for what they will need to do in class; and 3) implementation phase, a time for proactive learning, typically consisting of various forms of pair and group work in class.

It is important to note that all the in-class activities also followed the F-L-I-P™ principle prescribed by Hamdan et al. (2013)—one of the most widely cited and referred principles for practitioners when constructing a flipped classroom. According to the F-L-I-P™ principle, four pillars need to be considered when constructing the activities in a flipped classroom: (a) **F**lexible environment pillar: teachers and students are encouraged to use ‘sustainable’ materials—usually in the form of video—that can be flexibly retrieved and viewed any time; (b) [autonomous] **L**earning culture pillar: students come to the class with the knowledge learned from the previewed materials and in-class time is mainly devoted to student-centered learning activities without heavy reliance on the instructor; (c) **I**ntentional content pillar: learning materials that best suit students’ level and progress are carefully chosen and delivered to students; and (d) **P**rofessional educator pillar: while taking on the facilitator role, teachers should constantly monitor students in the background, providing students with professional feedback relevant to the moment. Further details on the three flipped classroom implementation phases and relevant activities done during each phase are given below.

Preparation phase. As mentioned above, the work during the preparation phase was mainly completed by the instructor. During this phase, following the Intentional Content and Flexible Environment pillars, the instructor selected and produced six level-appropriate vocabulary instructional videos for the six-week treatment period, one video for each week. The six videos included recordings of the instructor delivering short lectures on the use, form, and meaning of the target vocabulary the students needed to master during the six-week flipped classroom instruction (15 target words per week; 90 target words in total), as well as supplementary materials prepared by the teacher. Each vocabulary instructional video was provided to students five days before the weekly meeting for previewing.

Additionally, during this phase, the teacher also created a platform on Facebook for classroom management purposes. This included but was not limited to announcing information, overseeing the previewing work, and distributing the instructional videos. This platform also allowed the entire class, including students who were absent, to preview and review instructional content (e.g., the six vocabulary instructional videos), to receive notifications from the teacher, to contact each other with questions or comments, to prepare for each weekly meeting and to practice after class. Accordingly, in addition to the classroom management purpose, the platform also provided sustaining learning resources for the students and allowed constant interaction between the teacher and students—the flexible environment pillar prescribed by Hamdan et al. (2013).

Acclimation phase. This phase took place *before* each weekly meeting. During the phase, the class had to first preview a vocabulary instructional video (usually 4-5 days before class) so that they could gain essential scaffold about the 15 target words from the teacher. After previewing the instructional video, the group in charge of producing a vocabulary mnemonic video that week (the duty group) had to complete two preparatory tasks designed to help students take charge of their own learning environment

and become proactive (Bergmann & Sams, 2012). Details of these two preparatory tasks, all based on the autonomous learning culture principle, are given below in the order they occurred.

First, the duty group had to discuss creative ways to help their peers to learn and remember the 15 target words for that week. Based on their discussion, the duty group then produced a 20-minute vocabulary mnemonic video to be viewed by the whole class during the upcoming weekly meeting. They were given roughly 1 minute to introduce mnemonic information for each word in the video. The students were encouraged to present the vocabulary mnemonic video as creatively as possible. This task is designed to meet Bergmann and Sams' (2012) urge to include constructive-associative activities in a flipped-classroom environment.

Second, the duty group also had to design and prepare a worksheet (2 pages) on which their peers could take notes and draw while watching the vocabulary mnemonic video in class. The worksheet was divided into a notetaking section (for students to jot down any linguistic notes) and drawing section (for students to sketch nonlinguistic visual images). See Figure 1 in the Results Section for an example worksheet. The purpose of the notes and drawings were two-fold: 1) to ensure that the students indeed attended to the videos and 2) to reinforce the students' memory of the target words.

Implementation phase. This phase took place during the 50-minute weekly class meeting and included five major in-class tasks. Details of these tasks, which are all student-centered in nature, are described below in the sequence they were completed in class.

Task a. Q&A time for the vocabulary instructional video prepared by their teacher (5 minutes): The teacher asked the students to raise questions or queries regarding the instructional video they had previewed prior to class and provided answers or brief explanations whenever necessary.

Task b. Viewing time for the vocabulary mnemonic video prepared by the duty group (20 minutes): The whole class viewed the vocabulary mnemonic video together. Importantly, while watching the video, students were instructed to take notes and draw pictures of difficult or unfamiliar target words on the worksheet prepared by the duty group. Taking idiosyncratic notes and illustrations allow students to personalize their learning input, allowing them to benefit from individualized and/or personalized education (Bergmann & Sams, 2012).

Task c. Vocabulary review (10 minutes): The whole class used this time to review the content learnt from the mnemonic video and/or to brainstorm with their group members in order to find an alternative way to remember the target words of the week. It is worth noting that the students played an important role when reviewing (task #c) and viewing (task #b) the mnemonic video and their input became a source of learning. This ensured that the students indeed fulfill the autonomous learning culture principle, taking an active part in their learning (Bergmann & Sams, 2012). While students actively participated in this review discussion task, the instructor closely monitored their discussion, and provided timely guidance and feedback to the students—a practice reminiscent of the Professional educator principle.

Task d. Vocabulary exercise (10 minutes): After the students finished reviewing the mnemonic video, the duty group used Kahoot to determine whether their peers had understood and learnt the target vocabulary. If needed, the teacher or the duty group assisted specific students to learn the new vocabulary through brief 'personalized' teaching or feedback.

Task e. Self-reflection and peer evaluation sheet (5 minutes): Finally, the students used their smartphones to type self-reflections, evaluate their peers, and also complete their own learning diary to assess their performance and learning in the class.

After each weekly meeting, the vocabulary mnemonic video was uploaded to the class FB site. Students were thus able to review both the vocabulary instructional videos prepared by the teacher and the vocabulary mnemonic videos prepared by their peers on demand.

The conventional lecture-based classroom

The conventional lecture-based classroom (Class B) mainly used a deductive narrative teaching approach, a method widely-used in high school English classes in Taiwan. Following this approach, no obligatory previewing work was required. The instructional content was mainly deductively offered to the Class B students. During each weekly class meeting, the teacher provided Class B students with information regarding each word's pronunciation, part of speech and supplied example sentences. On average, 2 to 3 minutes was spent on teaching each word, resulting in a total time of 40 to 50 minutes. This is similar to the time Class A (the flipped classroom group) spent viewing their weekly instructional video. In addition, after each weekly meeting, a handout was distributed; this handout provided the students with relevant exercises and extended vocabulary information (e.g., prefixes and suffixes, collocations) for self-study and review.

Notably, while students in the flipped classroom were put in small groups following the heterogeneous grouping principle and were frequently engaged in group discussion and interaction activities, the students in the conventional lecture-based classroom were not put in groups and only received one-way lecture-based instructional input from the teacher.

Instruments

As this study aimed to compare the effect of the flipped classroom on students of different English levels regarding English vocabulary acquisition, the assessment tools used to answer the research question were as follows: An English vocabulary assessment, and an exit questionnaire. The vocabulary assessment was used to compare vocabulary learning between the conventional classroom and the flipped classroom, while the questionnaire was used to probe the students' perceptions of the most effective elements in the flipped classroom environment.

Vocabulary assessment

This assessment tool consisted of a vocabulary pretest and posttest, which took place one week before and after this six-week study, respectively. Thus, the interval between the two vocabulary tests was eight weeks. The pretest and posttest included the same vocabulary multiple-choice questions: 90 multiple-choice questions (testing the participants' knowledge of the 90 target words) and 10 filler questions. The pretest and posttest, however, differed in terms of the sequence in which the test items were presented. The difference in the presentation sequence, the interval between the two tests (8 weeks), and the use of filler items all significantly reduced any practice (or memory) effect regarding the participants' performance on the posttest. One point was awarded for correctly answering one multiple-choice question. The highest score was 100 both for the vocabulary pretest and posttest. Both tests took about 50 minutes to complete; however, the participants were given a five-minute break after finishing half of the test items to reduce any fatigue effect.

Exit questionnaire

A day after the participants took the vocabulary posttest, the Class A students were asked to fill in a short survey created with Google forms. The questionnaire consisted of two major exit questions. The first exit question asked both the participants from Class A and Class B to rate their perception of the effectiveness of the instruction method they received on a six-point Likert scale (1 = Strongly disagree; 2

= Disagree; 3 = Slightly disagree; 4 = Slightly Agree; 5 = Agree; 6 = Strongly Agree). The statement for the first exit question reads as follows: “The instruction you received (flipped classroom instruction for Class A and lecture-based instruction for Class B) is useful for learning English vocabulary.”

If a participant from Class A (flipped classroom) chose a positive answer in response to the first exit question (i.e., choosing 4, 5, or 6 points), they also responded to the second exit question, whilst students who responded with a negative answer did not. The second exit question asked the students to ‘tick’ the element of flipped classroom instruction that they felt had contributed most significantly to their learning outcome, that is, the top determinant of their success in the flipped classroom. The given elements were (1) Heterogeneous group work; (2) Preparation prior to class (i.e., viewing instructional videos and producing mnemonic videos before class); (3) Immediate technology-assisted vocabulary exercise through Kahoot; (4) In-class proactive learning techniques (i.e., notetaking and drawing while viewing mnemonic videos). Students who answered the second exit question also were asked to provide an (open-ended) explanatory account for their choice.

Data Analysis

A t-test was conducted to see whether there was any significance between the results achieved by the flipped classroom students and the students in the conventional lecture-based classroom. Additionally, a T-test was conducted to see whether there existed any significant difference in improvement between the “high achievers” and “low-achievers” in Class B—the class which had received flipped classroom instruction. Finally, information from the exit questionnaire was used to explore the students’ perceptions of the major components of flipped classroom instruction.

Results

Vocabulary Assessment

In terms of between-group comparison, the T-test did not detect any significant difference between the experimental group’s (Mean = 79.1; SD = 10.93) and control group’s (Mean = 81.69; SD = 9.99) performances on the pretest. This, as shown in Tables 1 and 2 below, suggests that the two groups were on an equal footing prior to the treatment. As also evident in Tables 1 and 2, the T-test did not capture any significant between-group difference between Class A (Mean = 92.38; SD = 7.966) and Class B (Mean = 92.89; SD = 9.19) on the vocabulary posttest either, in spite of the significant diachronic within-group difference in both Class A and Class B ($p < 0.01$). This indicates that both instructional methods indeed led to substantial vocabulary gains; however, both groups did not exhibit significant between-group differences in their performance on the vocabulary posttest.

However, this result, obtained from the *between-group* comparison on the vocabulary posttest, should be interpreted with care. Specifically, at first glance, the above results appear to suggest that the flipped classroom instruction was not effective in ‘overturning’ students’ learning mechanisms, probably due to a habitual reliance on the deductive lecture-based instructional method. This notwithstanding, if we consider ‘*diachronic within-group difference*,’ the benefit of the flipped classroom instruction surfaces. Specifically, the experimental group improved by 13.28 points between the vocabulary pretest and posttest, a significantly higher diachronic gain than the diachronic gain of the control group (11.2 points; $p < .05$). The above observation suggests that flipped classroom environment was more effective in leveraging students’ L2 vocabulary gains over time. In L2 research, vocabulary gain is typically assessed in two possible settings: 1) novel vocabulary acquisition; and 2) acquisition of partially-learned words. In the former setting, it is important to prove that participants indeed have zero knowledge of the target vocabulary prior to the treatment; in this case, any vocabulary gain/growth can only be attributed to the treatment. In the latter setting, participants already have some knowledge about the target vocabulary, as

established by the pretest—which is exactly the scenario of the current study; in this case, whether the participants indeed have vocabulary gain can be established by statistically-significant difference between the pretest and the posttest, namely, statistically-significant diachronic within-group difference. And this is exactly what we established in this study, there is a statistically-significant difference in the experimental group’s vocabulary knowledge over time, as gleaned from the score difference between the pretest and posttest. The above reasoning and design (establishing gain in partially-learned L2 forms through diachronic within-group difference) are frequently seen in empirical studies published in many prestigious journals such as the *Journal of Asia TEFL*, *Language Learning*, *Language Teaching Research* (partially-learned L2 vocabulary: Kohnke, Zhang, & Zou, 2019; partially-learned L2 morphosyntax: L2 Revesz, 2012; Wacha & Liu, 2017). The concern that participants’ existing knowledge of target L2 vocabulary prior to the treatment may be a confounding variable selectively affecting high and low-achiever’s gains can be alleviated because, as noted in the first paragraph of the Results section, there was no statistic difference between the high- and low-achievers. In this case, the observed vocabulary gain in high- and low-achievers cannot be attributed to differences in their existing vocabulary knowledge prior to the treatment.

TABLE 1
Descriptive Statistics for the Experimental and Control Groups

		<i>N</i>	<i>M</i>	<i>SD</i>
Vocabulary Pretest	A	42	79.10	10.930
	B	45	81.69	9.991
Vocabulary Posttest	A	42	92.38	7.966
	B	45	92.89	9.190

TABLE 2
Comparisons between the Experimental and Control Groups

	<i>F</i>	<i>Sig.</i>	<i>T</i>	<i>df</i>
Vocabulary Pretest	.788	.377	1.156	85
Vocabulary Posttest	.190	.664	.275	85

In spite of the above positive evidence, whether the flipped classroom instruction equally benefited both the high and low achievers in this class requires closer examination. Overall, as noted above, there was a 13.28-point within-group diachronic difference between the pretest and posttest for Class A—the class receiving flipped classroom instruction. As shown in Table 3, the high achievers (> 50% percentile) improved by an average of 11.57 points between the vocabulary pretest and posttest. This improvement (11.57 points), nonetheless, is still lower than the 13.28-point class average. On the other hand, the low achievers (< 50% percentile) improved by an average of 14.99 points. Notably, the low-achievers’ within-group diachronic improvement (14.99 points) was significantly higher than the 13.28-point class average ($p < .05$). The above findings jointly indicate that attainment levels (high vs. low achievers) indeed played a pivotal role in modulating the effectiveness of the flipped classroom instruction. To confirm this view, a post-hoc analysis was performed. This confirmed that the high achievers’ diachronic vocabulary gain (11.57 points) was significantly below that of the low achievers’ (14.99 points; $p < .001$), indicating that the flipped classroom instruction seems to have been more beneficial for the low achievers.

TABLE 3
Descriptive Statistics for High and Low Achievers in the Flipped Classroom Instruction

English Proficiency	<i>N</i>	<i>M</i>	<i>SD</i>	<i>SEM</i>
High achievers	23	11.57	7.719	1.472
Low achievers	19	14.99	7.057	1.421

Exit Questionnaire

The first exit question explored perceptions regarding the effectiveness of the instruction. The results reveal that *all* the flipped classroom participants responded positively to this question, stating that they either strongly agreed ($N = 35$) or agreed ($N = 7$) that the flipped classroom had been useful for vocabulary learning. In contrast, only 48% (22 out of 45) of participants in the control group responded positively regarding the effectiveness of the lecture-based instruction. Accordingly, although the lecture-based instruction led to some vocabulary gains, it did not unequivocally foster a positive mindset—a finding also observed in Webb et al.’s (2014) study—probably due to learners’ habitual reliance on the input provided by the instructor. This indicates that lecture-based instruction should be implemented with certain caveats. The ensuing subsections cover the results of the second exit question, which asked the flipped classroom participants for their perceptions regarding the most beneficial components of flipped classroom instruction.

Heterogeneous group work

Slightly over 32% of the experimental group members ($N = 14$) either strongly agreed ($N = 10$) or agreed ($N = 4$) that heterogeneous group collaboration was the most important determinant of the flipped classroom instruction. Two explanations were provided for this viewpoint: (1) the heterogeneous group work taught people to appreciate input from each other—even from the low-achieving group members—and (2) it had the potency to help each group member find a role in achieving common goals.

In terms of the first explanation (appreciating each other’s input), two high-achievers stipulated that “heterogeneous group work allowed me to know more about the strengths of my group members...we discussed different interesting methods—some of which actually came from the ‘least-expected’ partners—that could help us learn and remember English words”—a statement also pointed out by six other high-achievers. As for the low-achievers, they saw heterogeneous grouping as promoting rather than debilitating collaboration between high and low achievers. In this vein, three low achievers noted “Sometimes it took us [low achievers] a long time to think up a way to present a word, but seeing everyone [low and high achievers alike] work together really made the effort worthwhile.” Thus, although students of different vocabulary attainment profiles played different roles in the group, all of them were willing to contribute, to help boost each other’s performance, and to learn from each other.

In terms of the second explanation (helping each other to find a role), four high achievers explicitly mentioned that they took the role of group leader, leading discussions and allocating work to the other group members. Four low achievers said they did not take on the role of leading group discussions. However, they noted that “with guidance from some outstanding group members [high achievers], they actively took part in discussions” and that “everyone was pleased with their supporting roles, especially when creating the vocabulary mnemonic videos, presenting them, and teaching the class.” These views all indicate that ‘leadership’ from high achievers does not necessarily intimidate low achievers from participating in heterogeneous (collaborative) group work, especially when there is a shared goal.

Preparation prior to class (i.e., Viewing instructional videos and producing mnemonic videos before class).

43% of the students ($N = 18$) strongly agreed that the process of viewing the instructional videos and acting on what they had learned to produce mnemonic videos was the top determinant of the flipped classroom instruction. This implies that rather than feeling upset about the extra workload prior to class, nearly half the flipped classroom participants felt more ‘willing’ and ‘motivated’ to spend time studying vocabulary so that it could be creatively presented to the class via the mnemonic videos. As such, vocabulary learning ceased being a process of repeatedly trying to memorize a word and became a proactive and autonomous learning process driven by intrinsic motivation. One student mentioned in the questionnaire: “I think this (flipped classroom) class is really different than before. We used to sit in class and just listen to the teacher. Now we have to do it ourselves which is much more interesting and helps me remember more too.” Another student said, “I hope we can do this (flipped classroom) again next semester. Watching others’ videos and making one ourselves is much more vivid.” Notably, these 18 students all indicated that because of the input from their peers, they were more willing to raise questions in class either for clarification or comprehension purposes. Such responses provide testimony for the efficacy of previewing and preparatory work in the flipped classroom for enhancing intrinsic motivation.

Notably, nearly two-thirds of those who choose preparation work as the most important determinant ($N=12$)—the low-achieving students in particular—indicated that their intrinsic motivation could be attributed and linked to their desire to supply meaningful input in a collaborative student-centered learning environment. They said that they wanted to be able to teach their peers something from time to time and that this tutoring process helped them to better synthesize and hence retain information. According to Dale (1946), 90% of information can be retained when one is teaching another or applying newly learned information, whereas only 5% is remembered through passive listening. Students creating learning videos, learning new vocabulary while simultaneously teaching others, seems to support this theory. Finally, apart from learning vocabulary, two flipped classroom participants mentioned that producing mnemonic videos helped them learn to present material in an organized and logical way.

Immediate technology-assisted vocabulary exercise through Kahoot

In this study, Kahoot offered both the teacher and students a platform to quickly practice and assess their vocabulary learning outcomes through timed responses to multiple-choice questions. 10% of the Class A students ($N = 4$) chose these technology-assisted exercises as the most important determinant in the flipped classroom because they turned a traditional classroom exercise into an engaging and interactive process. Specifically, the application allows each participant to check and verify their answers, as well as answers from others, thereby making the app simultaneously a personal and interactive protocol. Those who chose the technology-assisted exercises as the top determinant indicated that “Kahoot can be very intense and exciting, so everyone loves playing it.” [emphasis added]. This quotation is particularly interesting because it indicates that Kahoot turned the assessment process into a fun and engaging gaming experience.

Importantly, the four participants who voted Kahoot as the key determinant of flipped classroom instruction noted that “we preferred Kahoot to traditional exercises on paper, because it is not only engaging but also stimulates healthy competition among students...it [Kahoot] provides an opportunity to interact with the entire class in a non-threatening environment.” [emphasis added]. This suggests that technology-assisted vocabulary exercises (in this case, Kahoot) can turn the traditional exercise or assessment experience from individual work to community interaction, with the potency to foster a positive affect and a sense of community.

In-class proactive learning techniques, i.e., notetaking and drawing while viewing mnemonic videos

One might recall that Class A students were asked to take linguistic and/or pictorial/illustrative notes for words that were novel, unfamiliar, or difficult. 15% of Class A students (N = 6) felt that this was the top determinant of effective flipped classroom instruction. In particular, these six students—four high achievers and two low achievers—reported that they would incorporate pictures in future when learning vocabulary. They noted that, “pictures are more effective than linguistic cues in retrieving information about the target vocabulary... whenever I draw I remember the words better.” Interestingly, no one cited taking linguistic notes as an effective proactive learning technique.

The six students uniformly explained that they found producing pictorial or illustrative notes as the most important element in an effective flipped classroom setting because “pictorial/illustrative images are strongly related to a personalized “concept”. Specifically, to produce pictorial or illustrative note requires one to draw on existing conceptual knowledge and past experiences. For instance, to draw a picture for the target word grumpy, one may consciously recollect grumpy faces one has seen in the past. These participants noted that personalized and conscious conceptual input is often missing in conventional instruction and that personal conceptual involvement leads to stronger and more long-lasting memory traces about the target vocabulary.

Figure 1 below shows two representative examples of notes taken by Class A students. Notice that their notes all involved generative (i.e., non-verbatim) ‘pictorial/illustrative’ notes, which are more helpful for later retention and retrieval because they connect personal concepts and experiences with the target vocabulary. This probably explains why producing ‘pictorial/illustrative’ notes was regarded by the students in the flipped classroom as a useful proactive learning technique.

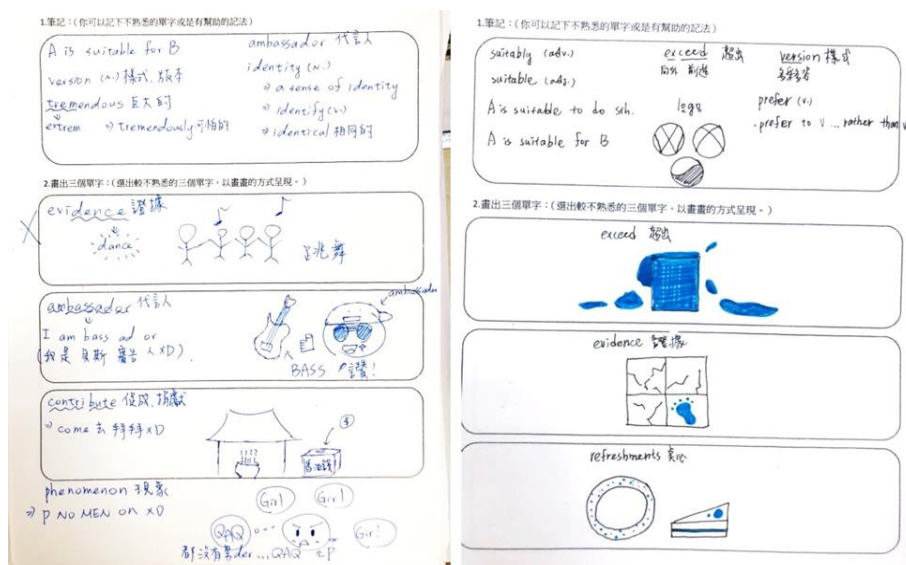


Figure 1. Linguistic and pictorial/illustrative notes produced by students in the flipped classroom.

Discussion and Pedagogical Implications

In the ensuing paragraphs, we will discuss major findings of this study vis-à-vis each research question. Interpretation and/or explanatory accounts for each major finding will be provided whenever appropriate.

1. Is Flipped Classroom Instruction More Effective than Traditional Lecture-based Teaching in Enhancing the English Vocabulary Acquisition in Multi-level Intact Classes?

As noted earlier, both flipped classroom and lecture-based instruction led to vocabulary gains. However, as noted in the results section, the flipped classroom instruction seemed to be more effective in leveraging diachronic vocabulary gains than the conventional lecture-based instruction (13.28 points vs. 11.2 points). Importantly, one may also notice that the standard deviation value—which is indicative of the score variation and dispersion of a set of data—for students who received flipped classroom instruction was significantly smaller ($SD = 7.9$) than that for those students who received lecture-based instruction ($SD = 9.1$). This smaller SD value indicates that the flipped classroom instruction was more effective in reducing the differences among the high and low achievers, although, as discussed in the results section, it is probably particularly helpful for the low achievers. So, while both the lecture-based and flipped classroom instruction proved to be effective and feasible way of ensuring vocabulary gains, instructors might opt to use the latter to reduce within-group difference. This is pertinent when teaching multi-level intact classes—the norm in Taiwan and many other Asian countries.

One possible concern from teachers interested in adopting the flipped classroom may be the extra workload imposed on students. In the current study, the flipped classroom required the students to go through the target content before class and create instructional material. In other words, the flipped classroom no longer has students sitting in front of a teacher. Instead, students need to prepare and study the class content before the class, and have to actively attend and respond to the learning material in class, with the teacher only offering support, explanations, and/or guidance when necessary. Thus, it is fair to say that students in a flipped classroom setting are kept mentally busy and are required to do more work both before and during a class.

Note, however, that the Class A students, as gleaned from their collective (100%) positive response to the perceived usefulness of the instruction they received (Exit question#1), generally were not troubled by the additional workload prior to class¹. In contrast, only 48% (22 out of 45) of participants in the traditional lecture group responded positively to the work in the lecture-based instruction. This finding is consistent with Chen-Hsieh et al.'s (2016) study reviewed earlier. The participants in Chen-Hsieh et al.'s study noted that although “there was additional workload in the flipped classroom setting,” the participants expressed in the interview that the workload was “not heavy.” The reason given was that only one video was required to be made by each group over the entire semester (similar to the design of this study) and almost everything was group work. Importantly, the participants Chen-Hsieh et al.'s study, as did the participants in our study, noted that they did not feel that the extra work was demanding because they perceived it as ‘beneficial.’

Taken together, the joint insight from Chen-Hsieh et al. (2016) and the current study is that concerns about the flipped classroom increasing the workload on students may be alleviated if students see the ‘benefit’ and “usefulness” of the work, and this may be achieved via heterogeneous group work whenever appropriate. In fact, the participants of the current study indicated that rather than seeing the extra work as a burden, they saw the collaborative work as a way to boost their “intrinsic motivation.” With this in mind, the remaining job for the teacher is to carefully impose a structure upon the major events and activities before and during class, offering specific and clear information about what students need to do both individually and in groups.

¹ It is true that only the participants who chose a positive answer need to provide further thoughts. In this case, one may question that the participants' further thoughts will not provide a fair ground for determining the effect the flipped classroom practice. It is important to note that *ALL* participants assigned to the experimental condition (flipped classroom) provide a favorable rating (choosing 4, 5, or 6 points) toward the treatment they received—which is definitely not a coincidence. In this case, there was *NO* subjective selection or screening involved. All of their further thoughts only helped us to gain further insights into the reasons behind their positive responses.

In spite of the merits of flipped classroom instruction, the participants' responses to the second exit question reveal that they had different perceptions regarding the relative contribution of the four major tasks they went through during the acclimation and implementation phases. Specifically, the perceived importance of the four tasks were, ranging from the highest to the lowest: (1) preparation prior to class (43%); (2) heterogeneous group work (32%); (3) in-class proactive learning techniques, i.e., notetaking (15%); and (4) technology-assisted vocabulary exercises using Kahoot (10%).

The preparatory work prior to class was rated by the students as being the most important component of the flipped classroom. This result, along with their unequivocal (100%) positive responses to the first exit question (perceived usefulness of flipped classroom on a six-point Likert scale) indicates that the students were generally very positive about the preparatory tasks required by the flipped classroom instruction and saw it as the key to the success of their learning. Heterogeneous group work received the second highest rating, indicating that it was valued by the students and played an important role both in in-class activities and after-school work. In light of this, teachers may want to explore various in-class and after-school heterogeneous group work possibilities.

In-class proactive learning (i.e., notetaking) and technology-assisted exercises (i.e., using Kahoot) received the second lowest and the lowest rating probably because both exercises required a lot of work on the part of students. Nevertheless, both the high- and low-achievers' qualitative comments reveal that these two exercises could lead to a positive attitude toward assessment and foster a pleasant and interactive experience that is conducive to a sense of community.

2. Does Flipped Classroom Instruction Exert a Selective Effect on High- and Low-Achievers' Vocabulary Acquisition?

Notable progress can be seen from flipped classroom instruction on students of different achievement levels. That is, the flipped classroom benefited both high and low achievers, albeit to different extents. Indeed, as noted in the results section, the diachronic vocabulary gain of the high achievers was significantly below that of the low achievers; that is, the low achievers showed most improvement. The above findings suggest that heterogeneous grouping significantly leveraged the gains of the low achievers. Although the flipped classroom seemed to exert a selective effect on students of different attainment levels, it fostered a positive mindset in both the high and low achievers. The qualitative data shows a positive effect on their willingness to raise questions in class. Specifically, students of different levels were more motivated to raise questions and help each other with problems or questions. Excellent students (high achievers) can strengthen their learning while teaching other students (Dale, 1969), while the other students can receive help and support from both their peers and the teacher (Johnson & Johnson, 2009). This point is corroborated by Syu's (2015) study, which observed that students enjoy the flipped classroom due to interactive and collaborative learning with peers of different levels and gain a better understanding of the learning content.

An interesting finding from the responses to the second exit question calls for further deliberation, with many "low achievers" noting that they wanted to be able to teach their peers something and were happy to find such a role in heterogeneous group work—a finding also observed in Chen and Liu's (2019) study reviewed above. This challenges the traditional misconception that low achieving students have no internal drive to improve. However, it seems that when put in the 'right' environment, low achieving students' desire to learn can surface and their input can often surprise high-achievers. As noted earlier, one high achiever wrote that they [high achievers] learned to accept and appreciate input from their peers and some intriguing ideas actually came from "the 'least-expected' partners" (a euphemism for 'low achievers').

Despite the manifest facilitative effect of the flipped classroom on the lower achieving students, guidance and monitoring from a teacher is still needed. Specifically, considering that student input is an important part of learning in the flipped classroom, teachers need ensure that students gather accurate information from appropriate sources. With this in mind, to prevent students accessing incorrect

information teachers should be encouraged to instruct students on how to search for reliable information online and/or provide appropriate sources.

Conclusion

This study shows that the flipped classroom benefits students of different achievement profiles and can turn them into autonomous learners, at least in courses focusing on vocabulary. While recognizing the effectiveness and possibility of this student-centered approach, teachers may want to develop various kinds of interdisciplinary flipped classroom. Hopefully, students will embrace an increasing number of courses designed to encourage and promote independent thinking and the practical application of skills. In spite of the positive evidence obtained from this study, the effectiveness of the flipped classroom is yet to be established in other language (sub)domains, using a larger sample.

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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